Planetary In-Situ X-Ray Imager for Core Samples, Phase I

Completed Technology Project (2018 - 2019)

Project Introduction

We propose to develop an in-situ X-ray imaging instrument to analyze core samples on the surface of a planet or planetesimal. The instrument will also serve as an X-ray computer tomography (XCT) instrument and X-ray spectrometer to map the chemical composition of the surface of the rock core when its surface is not shielded by an opaque container. The instrument will rely on a coring drill to collect and deliver the core sample. Several deployment scenarios are envisioned: analysis of ice cores that only require moderate acceleration voltage from the X-ray tube, analysis of rock cores bare or sealed in containers for sample-return, for which higher energy radiation is needed. The feasibility of a miniature ice-core XCT using technology readily qualified has been partly demonstrated in a preliminary study, the Phase I research will complete this task and demonstrate a proof-of-concept instrument. The engineering requirements of a rock core XCT will be investigated and compared to technology available for flight, especially with regard to high voltage components. The Phase II technical focus will depend on these findings.

Anticipated Benefits

Analysis of ice cores of the Mars Polar Layered Deposits to read Mars climatic records.

Analysis of rock cores for robotic in-situ science missions for astrobiology and geoscience.

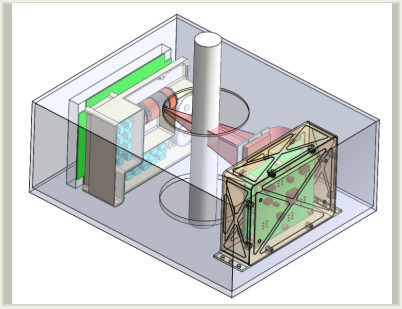
On-board analysis of rock cores sealed in canisters for sample-return, including on a Mars fetch-rover to analyze cores collected by the Mars 2020 rover and help assess best candidates for return to Earth.

On-board Space Station research instrument for the study of multiphase materials in microgravity.

Miniature X-ray tomography instrument for field applications.

Portable applications for cultural heritage materials that cannot leave their country, excavation site or museum.

Portable or robotic application for analysis of small objects for forensics, defense, homeland security, border control.



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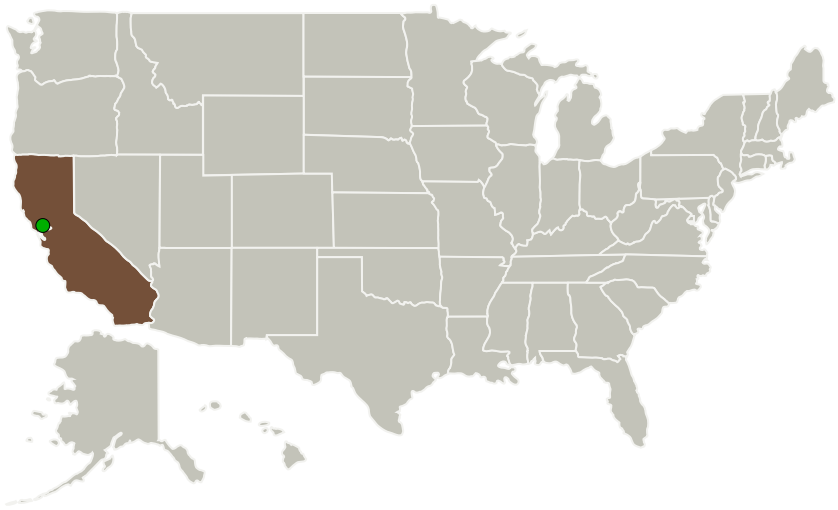
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
eXaminArt, LLC	Lead Organization	Industry	Los Altos, California
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations
California

Project Transitions

July 2018: Project Start

February 2019: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/141226)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

eXaminArt, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Philippe C Sarrazin

Co-Investigator:

Philippe Sarrazin

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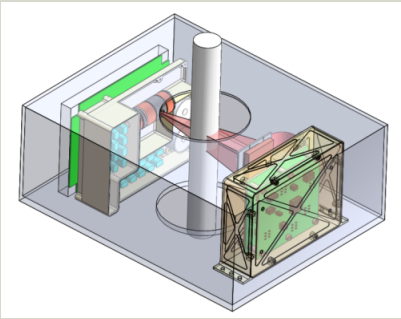
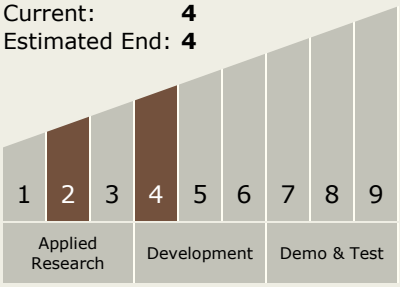
Images



Briefing Chart Image
Planetary In-Situ X-Ray Imager for Core Samples, Phase I
(https://techport.nasa.gov/image/130952)

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.2 Observatories
    - TX08.2.1 Mirror Systems

Target Destinations

Mars, Others Inside the Solar System